PATENT SPECIFICATION

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COMPLETE SPECIFICATION

An Actuating Mechanism for Electric Circuit Breakers

We, ELEKTRO-MECHANIK-G.M.B.H., of Wendenerhütte über Olpe/Westfalen, Germany, a German Company, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to electric circuit breakers particularly of high current carrying capacity, and the invention is concerned with the design and arrangement of the actuating mechanism with which such circuit breakers are usually equipped.

Circuit breakers of the kind mentioned must be capable of interrupting the current in the shortest possible time, in the case of a fault for instance. The arrangement is usually made such that a spring is tensioned when the circuit breaker is moved into its closed position and that the circuit breaker is held in this position by a lock device; by tripping the lock, the spring is released and effects a quick opening of the circuit breaker, i.e. a quick interruption of the current.

A conventional arrangement of this kind is shown in Fig. 1 of the accompanying drawings. A circuit breaker 11 is mounted on a frame 10. A sleeve 12 projects upwards from the top of the breaker casing; it accommodates a movable rod which carries the movable contact (not shown) of the circuit breaker. The sleeve has a longitudinal slot through which projects a pin 31 of the movable contact rod. The pin 31 is linked to an actuating lever 32 which is fast on a shaft 23 rotatably supported in the frame 10. Each time it is desired to close the circuit breaker, the shaft 23 and the lever 32 have to be turned in an anti-clockwise direction, if the device is viewed as shown in Fig. 1. Likewise rigidly connected to the shaft 23 is a lever 34. A strong spring 15 is connected to its free end, the other end of the spring may be anchored on the frame 10. It will be seen, that this spring is tensioned when the actuating lever is caused to move in an anti-clockwise direction to close the breaker, and the spring, when released, will rotate the shaft 23 and the actuating lever 32 in a clockwise direction to lift the pin 31 and to open the circuit breaker. A dashpot 14 is operationally connected to the shaft 23 to prevent shocks from occurring during the switching actions. For turning the actuating lever 32 into its closed position, a motor drive is provided, which comprises a motor 19, a worm-gear 35, a clutch 18, a transmission linkage 17, 16 and 36 and a ratchet wheel device 13. The ratchet wheel device comprises two wheels, the one which is seen is mounted free to rotate on the shaft 23, whilst a second smaller wheel (which is obscured by the larger wheel shown) is provided with the ratchet-wheel teeth and is rigidly connected to the shaft 23. The larger wheel carries a pawl (not visible) which engages the teeth of the smaller wheel, and the larger wheel is provided at the side shown with a pin 37 which is linked to the rod 36 of the transmission linkage. Thus when the motor 19 is started and the rod 36 is caused to move downwards as a result, the larger wheel of the pawl-and-ratchet device will be turned in an anti-clockwise direction, and due to the engagement between the pawl and the smaller toothed wheel, the latter will follow the mentioned rotary movement and thereby turn the shaft 23 to close the circuit breaker. The pawl is operationally connected with a trippping device (not shown) which is adapted to cause the pawl to release the smaller wheel of the ratchet device and therefore to open the circuit breaker. The larger wheel of the ratchet device and the transmission linkage remain in their position during the opening movement of the circuit breaker.

It has been found, however, that arrangements of the kind hereinbefore described are not reliable in service. Locks formed by a pawl and ratchet have a short useful life. Particularly the pawls are subjected to considerable wear, and after about 1000 operations a satisfactory and reliable engagement can no longer be expected. And a fault at the pawl lock prevents a closing of the circuit breaker even

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tion, since the driving member of the clutch is able to slip with respect to the driven member without any danger. From this slipping action the stopping of the driving motor may be derived, as mentioned hereinbefore. If it is required to effect a great number of switching operations in quick succession, the driving motor need not be disconnected.

If switching means are provided to re-energise the clutch shortly before the completion of the opening movement of the circuit breaker and if for instance a magnetic powder clutch is used, then the clutch effects a braking and damping of the breaker movement so that the oil dash-pot required hitherto can be omitted. In order to provide the possibility of closing the circuit breaker in the case the driving motor fails, it is advantageous to provide the output member of the clutch with a hand-operated actuating device, e.g. a hand-wheel, a hand-lever, or the like, by means of which the circuit breaker can be closed. After the circuit breaker has been moved into the closed position while the clutch was disengaged, the circuit breaker can be held in the new position by simply energising the clutch. In order to be able to operate the circuit breaker by hand and to hold it in its position also in the case that the clutch becomes defective, a ratchet-and-pawl locking device may be additionally provided, adapted to be operated by an emergency hand drive, which allows the holding of the circuit breaker.

Since the clutch requires the supply of an electric current to maintain the circuit breaker in its closed position, it may happen that the clutch starts to slip if a voltage drop occurs. This could produce a slow parting movement of the breaker contacts, and an arc would be set up at the contacts. In order to prevent this from occurring, it is advantageous to provide an end contact, i.e. a contact which disconnects the clutch when the clutch starts to slip and quickly releases the circuit breaker.

In the case of magnetic powder clutches, instead of an interruption of the energising current, it is also possible to cancel this current by the connection of a voltage of opposite sign.

WHAT WE CLAIM IS:—

1. An actuating mechanism for power operated electric circuit breakers which are provided with a spring device which is tensioned when the breaker contacts are closed and which opens the breaker contacts when released, characterised in that the actuating mechanism comprises a driving motor which through a transmission causes the circuit breaker to close, and that the transmission includes a self-locking member and between this member and the actuated member of the breaker an electrically controllable clutch, the energising circuit of which is intended to be connected to a tripping device so as to release the said spring by de-energising the clutch.

2. An actuating mechanism according to claim 1, wherein the electrically controllable clutch is a magnetic powder clutch.

3. An actuating mechanism according to claim 1 or 2, wherein the said self-locking member is formed by a worm gearing.

4. An actuating mechanism according to any of the preceding claims, wherein the clutch is associated with a switch for disconnecting the current supply to the electric driving motor when a slip occurs between the members of the clutch.

5. An actuating mechanism according to any of the preceding claims, wherein switching means are provided to re-energise the clutch, after it has been de-energised for releasing the spring device, just before the parting contacts of the breaker reach their end position.

6. An actuating mechanism according to any of the preceding claims, wherein the output member of the clutch is provided with an additional hand operated emergency drive.

7. An actuating mechanism according to claim 6, wherein the hand operated drive is associated with a ratchet-and-pawl locking device for holding the actuating mechanism in its open position.

8. An actuating mechanism according to any of the preceding claims, wherein an adjustable resistance is inserted in the energising circuit of the electric clutch for adjusting the time constant of the latter.

9. An actuating mechanism according to any of the preceding claims, wherein the clutch is associated with an end contact which disconnects the clutch if the latter starts to slip.

10. An actuating mechanism according to any of the preceding claims 2 to 8, incorporating a magnetic powder clutch, wherein the de-energisation of the clutch is effected by connecting a voltage of opposite sign to cancel the energising current.

11. An actuating mechanism for electric circuit breakers substantially as described with reference to and as illustrated in Fig. 2 of the accompanying drawings.

For the Applicants:
MATTHEWS, HADDAN & CO.,
Chartered Patent Agents,
31—32, Bedford Street, Strand,
London, W.C.2.

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808,125 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig.1

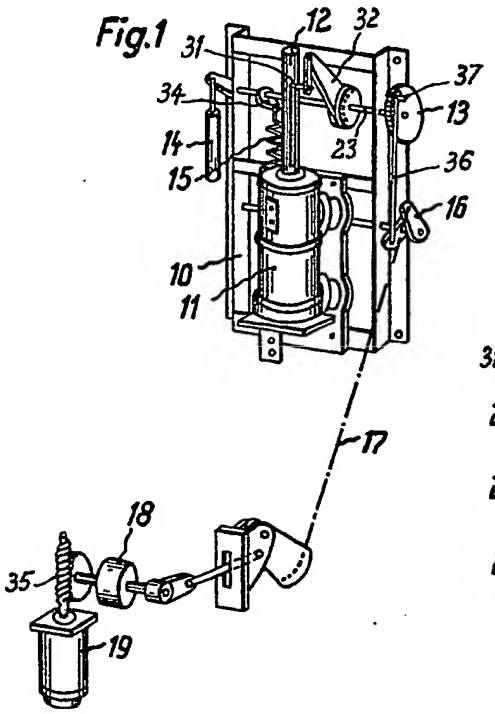

Fig.2